STRATEGIC MARKET PERSPECTIVE

U.S. Desktop Video Conferencing Market

1994-1999

U.S. Market Analysis Program

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U.S. Desktop Video Conferencing Market
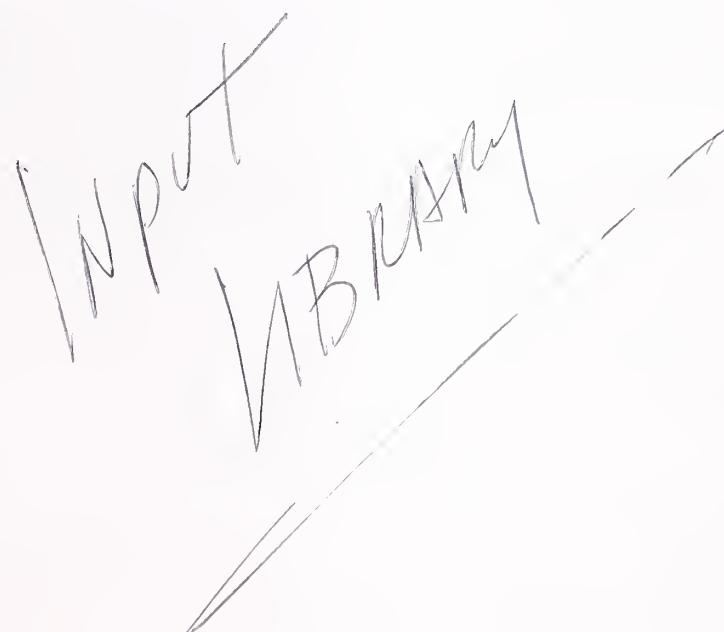
1994-1999

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Abstract

This special issues report provides an analysis and five-year
forecast of the U.S. Desktop Video Conferencing (DTVC) market
for the period 1994-1999.

The report addresses the leading trends and issues in this early
stage market. Several impediments exist before DTVC can
develop into a significant multi-media market. This report
addresses the leading impediments, from both the perspective of
vendors and users.

Changes required in infrastructure technoloies that support
desktop video solutions that will be required to "jump-start" the
DTVC industry are examined.

Recommendations are also made to vendors on product strategies
for creating more competitive DTVC solutions.

**U.S. Information Services Market
Analysis Program**

*U.S. Desktop Video Conferencing
Market, 1994-1999*

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Exhibits

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I

Introduction

This report and related research is part of INPUT's Market Analysis Program (MAP). This program provides market research, reports, consulting and recommendations to the management of leading vendors in the information services industry and to information systems functions of user organizations.

A
Scope

This report examines trends and issues affecting vendors providing Desktop Video Conferencing (DTVC) Solutions. The main focus of the report is on two issues:

- What is the current state of the art in DTVC technology?

- What are the principal impediments to widespread DTVC adoption?

The report also provides a five-year forecast on the size and growth rate of the current U.S. market for DTVC products.

B
Objectives

This report addresses the following trends and issues:

- The changes occurring in features and pricing in DTVC

- Potential markets for DTVC

- Product changes required for widespread DTVC adoption

C
Definitions

DTVC is the personalizing of video communications by putting video conferencing functionality on the desktop. It is an extension to the original video conferencing market for the room environment.

Historically DTVC price per seat costs referred to the cost of additional hardware peripherals and systems software to enable a desktop computer to utilize video applications.

The definition of DTVC product is changing as computer systems vendors enter the market with complete turnkey type solutions, including the desktop computer and storage and the DTVC software and peripherals.

D
Methodology

The following sources were used for this report:

- 44 interviews with IS and telecommunications managers at both Fortune 1000 companies and education institutions

- 20 interviews with vendors who provide various types of DTVC solutions

- Secondary research from INPUT's corporate library, which supplies on-going analysis of the U.S. information services markets

E
Report Structure

The remaining chapters of this report are organized as follows:

- Chapter II, Executive Overview, provides a summary of the contents of the report.

- Chapter III, Trends and Issues covers DTVC product development and examines issues which are affecting market acceptance

- Chapter IV, User Survey examines current usage levels of DTVC as well as prospective usage

- Chapter V, Competition provides a summary of products from leading vendors in the DTVC industry

- Chapter VI, Conclusions and Recommendations, summarizes INPUT's findings on the current DTVC market and proposes actions for DTVC vendors on alternative market approaches

- Appendix A: Questionnaire: Use of DTVC Applications

F
Related Report

- U.S. Wireless Communications Market, 1994-1999

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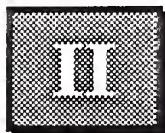
Executive Overview

A
Overview

DTVC allows two or more individuals to use their desktop computers for a face-to-face meeting while engaging in other activities of a regular meeting, such as talking, working on documents and sharing resource materials.

DTVC is a more personalized, lower-cost alternative to video room conferencing. However, DTVC solutions can also be used for remote participation with a video conference room site.

Desktop Video Conferencing (DTVC) represents an early stage, emerging growth market.

INPUT estimates a market size for DTVC products in 1994 of approximately $90 million and projects a five-year 35% CAGR in expenditures from 1994-1999. (Exhibit II-1) DTVC products are defined as enhancements to existing desktop computers which enable interpersonal video, audio and data sharing.

Recent interest in the DTVC market is being stimulated by a number of factors:

- Increasing number of vendors providing DTVC solutions

- Declining per-seat pricing

- Lower cost, multimedia enabled desktop computers

- General media emphasis on interactive video applications

Exhibit II-1

Estimated DTVC Market Size and Growth Rate
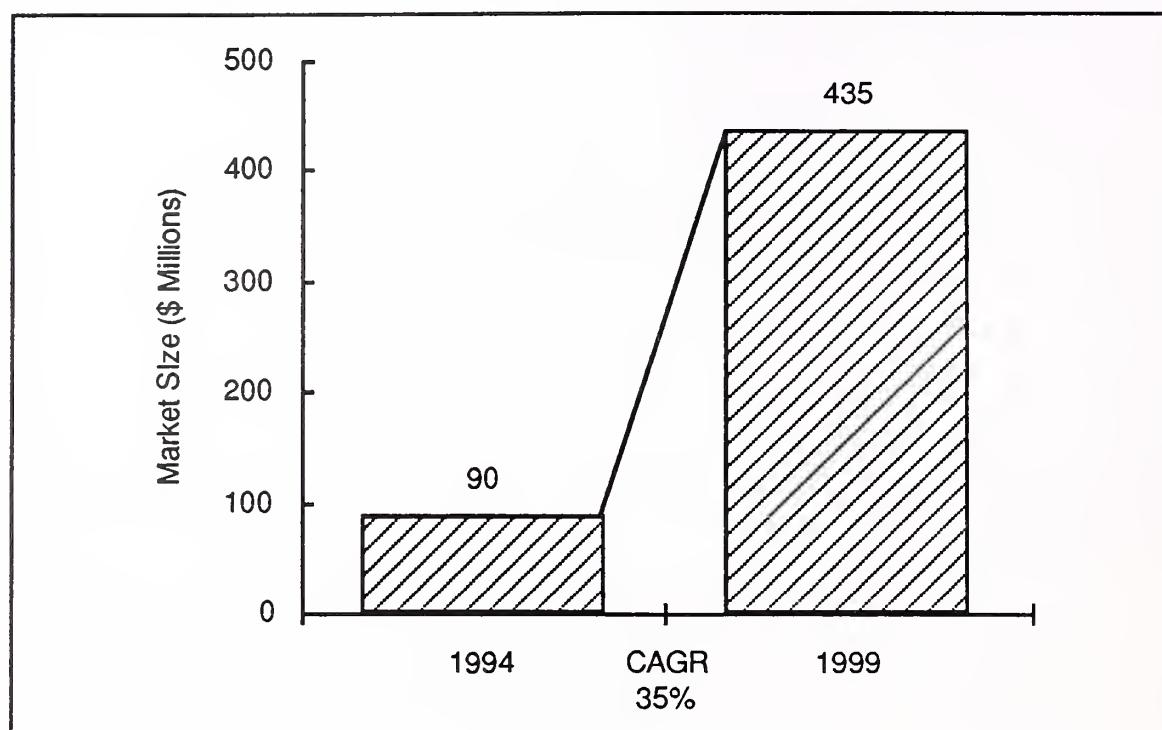
However, at this stage of market development, user desktop conferencing demand appears to be more for interactive desktop document collaboration. This type of desktop conferencing can be done across existing corporate LAN/WAN facilities, as opposed to many DTVC solutions which require additional WAN network leasing and/or usage expenditures.

INPUT's user survey on DTVC usage at larger U.S. corporations showed that the principal deterrent to widespread adoption of DTVC is network costs, as shown in Exhibit II-2.

Exhibit II-2

Deterrents to Corporate Implementation
of Desktop Video Conferencing
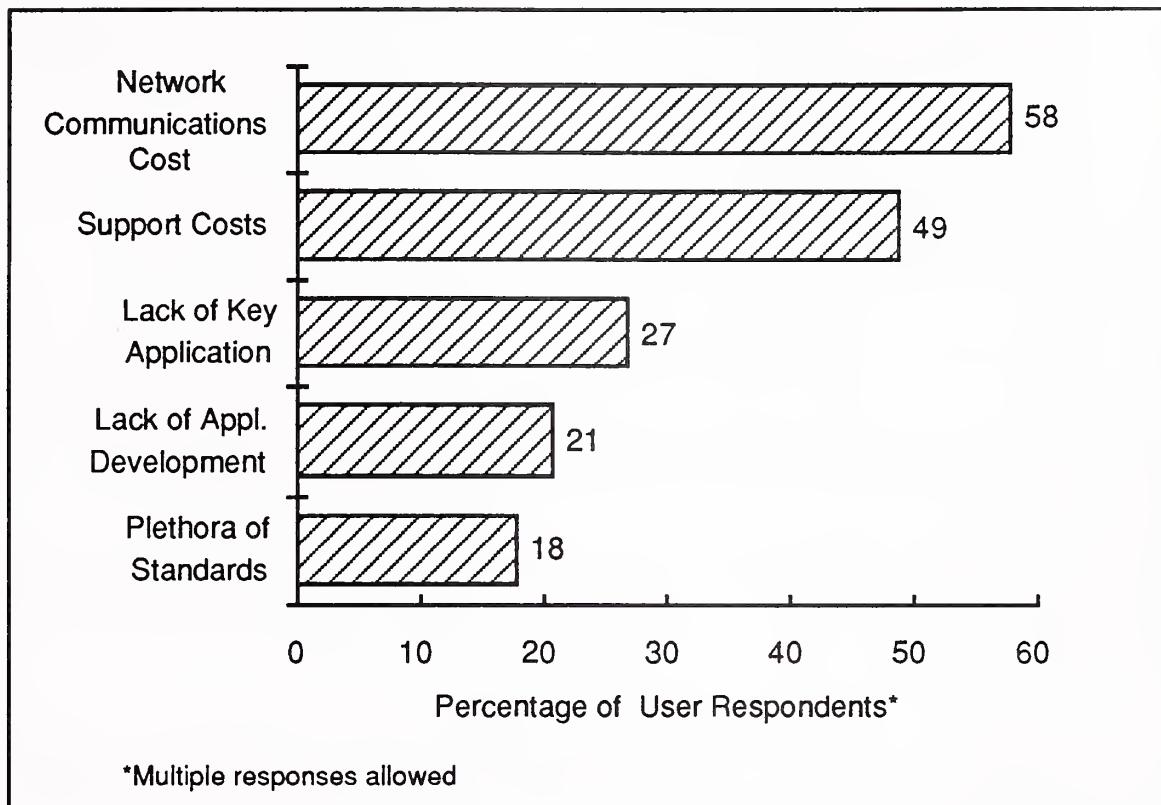
The inability of most existing DTVC products to utilize TCP/IP and IPX standards, is currently a major impediment to widespread adoption of DTVC.

The survey also showed that current price per seat costs were considerably above levels that would generate significant incremental demand. At $2,000 per seat there was a modest level of additional interest. A cost of $1,000 per seat was the first price point where statistically meaningful incremental purchasing would occur. Widespread adoption of DTVC would probably require per seat pricing of $300 or less.

INPUT's vendor survey showed a more recent trend in the DTVC industry toward product segmentation between lower cost "commodity" type solutions and high-end solutions which provide full frame, full motion video based on the use of existing inter-LAN network infrastructures.

Intel's entry into the DTVC market in 1993 with its ProShare DTVC solution set a new standard for per/seat pricing at approximately $2,500. Resellers of ProShare have also been discounting the product as low as $1,000 per seat.

A more typical per/seat price in the industry for a fully configured DTVC with near full-motion video and ISDN network linkage is $5,000 per seat.

Recently introduced high-end DTVC products that can provide higher fidelity video are based on RISC or high-end CICS microprocessors, high-speed local bus architectures and broadband into LAN routing. Prices for such products range from the $6,000 to $13,000 per seat level.

Significant interest in high-end solutions is evident in particular niche markets, such as the medical, financial services, engineering and design.

Users are usually highly paid professionals where time savings and video quality are very important to justifying the cost of the application.

Cross-industry market interest is more for customer service and remote training applications.

An important complement to high-end solutions is support services such as consulting, application development, systems integration and facilities management.

Principal vendor beneficiaries of the DTVC market are likely to be telecommunications equipment, network equipment and network services providers.

For widespread implementation of interactive video technology, new LAN-based switching technology, such as ATM and/or Fast Ethernet will be required. Fiber optic media will be required for widespread usage of interactive video applications in the corporate environment. Current high-end DTVC systems based on LAN protocols can require bandwidth utilization of 5% or more of a 10Mbps Ethernet LAN.

B

Conclusions and Recommendations

Exhibits II-3 and II-4 summarize INPUT's major conclusions and recommendations for vendors of DTVC systems.

Exhibit II-3

Major Barriers to Widespread DTVC Adoption

- Lack of LAN/WAN-based video networking solutions
- Current price per seat costs which are still prohibitive
- Lack of cross-product interoperability
- Lack of a mass-market type application
- Low-quality, synchronized multimedia transmission in many systems
- Lack of multipoint solutions
- Need to re-engineer work processes to accelerate corporate wide adoption

Exhibit II-4

Recommendations for Vendors Addressing the DTVC Market

- Partner with a telecommunications or other network requirement solutions vendor that can provide complementary equipment and services capabilities, particularly LAN/WAN ATM solutions, such as ADSL (Asymmetric Digital Subscriber Lines)
- Maximize profitability and market share by providing application development software tools and application development professional services
- Develop new generations of DTVC product that support multiple video and network communications protocols
- For low-end DTVC suppliers, reduce sales and marketing costs by utilizing indirect sales channels such as: distributors, large retailers, professional services companies, VARs, as well as telemarketing and direct mail
- High-end DTVC vendors should address vertical markets with a broad base of value-added services
- DTVC vendors with broad-based video technology capabilities should look to the video server store and forward (video mail), video-on-demand and broadcast video markets for much greater market size potential and profitability than the market for DTVC. These other types of LAN-based video applications could ultimately being the driving forces for widespread adoption of DTVC.

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Trends and Issues

A
Overview

1. History of Desktop Video Conferencing

Desktop video conferencing (DTVC) is a relatively new industry, with product shipments beginning in 1992.

Pioneer DTVC vendors were video conferencing room suppliers such as PictureTel and Compression Labs, Northern Telecom, AT&T, NEC and L.M. Ericsson, which provided telecommunications equipment with video conferencing systems.

Video on desktop PCs was made possible with the introduction of Quicktime for the Macintosh operating systems (Version 7.0) by Apple Computer and of Video for Windows by Microsoft.

A distinction must be made between video conferencing that requires a sender and a receiver and video players that require a receiver only. In desktop video conferencing fast image compression is required. In video player applications (which utilize alternative compression/decompression solutions) compression needs to be done on a more powerful machine than a typical desktop computer. The desktop receiver, however, need only be able to play the video at a reasonable speed.

In this report, we focus on DTVC where there is a sender and receiver.

A DTVC system solution provides synchronized digital transmission of video, audio and graphics signals on an interactive, real-time communications basis across a networking environment.

This requires hardware and system software add-ons to traditional desktop computer configurations which provide interactive data collaboration; analog to digital signal capture and conversion, video compression/decompression hardware or software and audio/video digital signal processing enhancements. A camera and voice handsets are also part of a full DTVC add-on solution.

Computer board manufacturers and custom semiconductor suppliers have traditionally provided many of these DTVC peripherals.

Systems suppliers may also manufacture their own video capture and compression/decompression boards and other DTVC peripherals or work with custom semiconductor companies for fabrication of custom chip designs.

The number of DTVC hardware and software solutions suppliers has significantly expanded over the past two years from five or so dominant players in 1992 to approximately 20 meaningful participants in 1994. This does not include VARs and OEMs which represent several times the number of software product and hardware systems manufacturers.

Since mid-1993 a number of the leading computer systems vendors have begun shipping DTVC solutions. These include companies such as Silicon Graphics, Sun Microsystems, IBM, Hewlett-Packard, AT&T Global Information Solutions, Digital Equipment and Unisys.

A major change in the industry occurred with the introduction in 1993 of Intel's ProShare Personal Conferencing Video System 200, based on its proprietary Indeo compression algorithm. Much of the video compression and decompression is based on Intel's Pentium microprocessor—which has the effect of reducing the cost of a DTVC solution while also potentially making codec processing a software programmable solution.

The Intel solution has established new price points for desktop video conferencing at $2499 per seat, with some of the company's major resellers, such as phone companies, selling the product at prices as low as $1,000 per seat. This is not unlike the cellular phone industry where the buyer purchases a product/server combination.

Intel is also working with a consortium of vendors to establish Indeo as an industry *de facto* video codec standard and ProShare as a *de facto* interactive data communication standard. A near-term result could be significant price reductions from competing vendors which could lead to early commodization of the DTVC market.

INPUT's interviews with DTVC vendors show that there is a "separate" market for high-end DTVC solutions that can provide high-speed LAN/WAN solutions and utilize existing corporate network infrastructures.

Systems software solutions for document collaboration are produced by a number of independent vendors. In addition, some systems software vendors are also providing the combined video, audio and data sharing DTVC solution—a more recent development.

The larger systems integrators appear to be at the stage of prototyping DTVC solutions. However, this is expected to change over the next two years, with systems integrators, outsourcers and VARs becoming major beneficiaries of the rapidly changing quality improvements in the products with expected further substantial reductions in hardware and software product cost.

A basic problem in the industry today is the matrix of multimedia protocol standards for interactive digital video, data and audio network transmission. The video room conferencing industry leadership was established around higher frame rate (384 Kbps over T-1 lines), proprietary video compression/depression algorithms. Nearly all of the leading vendors in desktop video conferencing have also based their product uniqueness, to a great extent, on their proprietary video codec algorithms.

More recently, many vendors have also incorporated the ITU (International Telecommunications Union, formerly CCITT) standards, such as H.320 and H.261 with line speeds in the range of 100 Kpbs. Alternative *de facto* standards established through vendor support, when combined with newer high-bandwidth communications technologies such as ATM, will probably facilitate the widespread availability of broadcast quality 30 fps standards-based solution. Current desktop video conferencing solutions based on H.320 and proprietary codecs over ISDN lines

generally provide 10-15 frames per second video resolution, resulting in jerky motion and low quality images.

2. Desktop Video Conferencing Market

a. Size and Projected Growth Rate

Vendors are usually reluctant to provide installed base and annual shipment rate figures, which makes it difficult to provide precise industry unit growth rates. However, INPUT estimates the shipment rate of DTVC systems in 1994 will be in the range of 35,000 units. Current vendor and user surveys suggest that desktop video conferencing is still an early stage market and that the market is probably two years away from accelerated growth.

A typical DTVC add-on solution to a PC or Macintosh platform includes: a video camera and microphone or telephone-style handset; speakers; board level products to capture and compress video signals; a network/communications adapter to integrate the audio and video data streams and transmit them over communications lines, possibly a telephony add-in board; and bundled software which provides the control for the video conferencing session, which generally now includes electronic whiteboards for document collaboration. Cost-per-seat definitions generally refer to the price of such add-on equipment, not the basic desktop computer and storage solution.

However, the definition of price-per-seat is changing with an increased shipment rate of preconfigured computer systems for multimedia applications, including desktop video conferencing. These include such products as the Silicon Graphics Indy workstation product which comes complete with CD ROMs, systems software and the basic workstation hardware software solution with a price range from $5,000 to approximately $20,000 depending on configuration. This bundled solution represents a more dominant trend as computer systems vendors add more multimedia software and peripherals to the original product configuration. This will continue to put more pressure on vendors providing desktop video conferencing "add-on" type solutions.

Independent vendors who can provide transprotocol solutions, cross-platform whiteboard conferencing and other "shrink wrap"

applications will continue to find market opportunities in sales to systems vendors and users.

INPUT's estimates on the size and growth rate projections on the worldwide desktop video conferencing hardware and software products market is summarized in Exhibit III-1.

Exhibit III-1

Desktop Video Conferencing Hardware and Software Add-on Product Market, 1994-1999
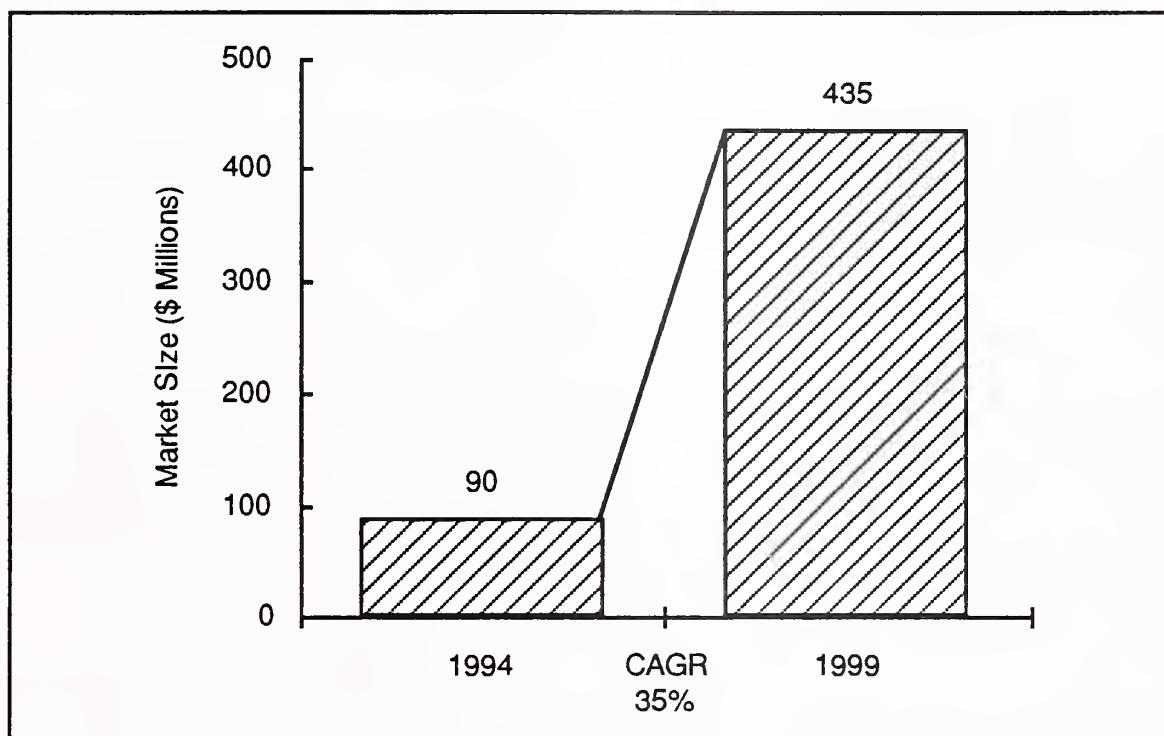
The U.S. portion of this market is estimated at 80%.

INPUT estimates that the market growth rate in units average considerably more than 50% CAGR growth within the next two years; however, severe price reductions on the order of 15%-20% per year for the industry will result in the lower CAGR in revenues.

The video group (room) conferencing systems and related services market, however, which began in the early 1980s, is much larger. INPUT estimates this worldwide market in 1994 to be approximately $750 million with a five-year projected CAGR of 15%-20%.

b. Factors driving the desktop video conferencing market

The widespread availability of multimedia enabling technologies is probably the key factor which is currently creating interest in desktop video conferencing. These include:

- Rapid growth in the installed base of multimedia enabled desktop computers, such as the Macintosh Quadra 840AV

- Improved compression algorithms for storing and transmitting digital video which lower storage and communications costs

- Incorporation of video systems software into the leading desktop operating systems software

- The rapid increase in the number of desktop computers attached to LANs

- The improvements in video application server technology

- Expansion in installed base of high-powered workstations with users who are comfortable with more complex networking-based applications

3. Evolution of the desktop video conferencing product

Prototype product for desktop video conferencing evolved from the product models provided by such video group conferencing industry pioneers as PictureTel and Compression Labs, Inc.

Significant price reductions in integrated CPU and other semiconductor components, have enabled the transfer of significant elements of the functionality of the original video conferencing solutions to PC-based desktop video conferencing with price points in the general range of $2500 to $5000. Other factors contributing to this include: major cost reductions in data conferencing software products; nation-wide availability of public digital networks; and continuing cost reductions over the past two to three years

Some of the key elements of this technology transfer to date include:

- Decreasing video processing costs associated with continuing improvements in high-density integrated circuits, such as single-chip codec and multimedia communications processors, and higher bandwidth local bus architectures and video accelerator boards—all of these help to enhance processing performance of newer, lower cost, lower bit-rate video codecs

- Increasing levels of semiconductor functional integration (with embedded video codecs) which is reducing the cost of multimedia add-on solutions

- Transfer of communications system software used in high speed interactive 3D graphics to enhancing desktop video conferencing communications, particularly by 3D workstation vendors

- Improving quality of digitized audio when combined in synchronized video/data environments with lower-cost semiconductor and software based Digital Signal Processing (DSP) solutions

- Improvements in media server storage and network management as well as technology breakthroughs that enhance the quality of video packet transmission

- Interactive data conferencing software products, that enable whiteboarding and other types of file sharing, along with synchronized audio transmission, have come down sharply to the $100 to $300 per user level with an expansion in the size of the market

- OLE-based application/file linkages which increase the efficiency of compound (multimedia) document sharing

- Continuing improvements in computer telephony solutions toward further integration of the functionality of ISDN technology with PBXs and LAN-based data servers, which could eventually greatly reduce the overall cost of LAN/WAN-based multimedia transmission

- Increasing vendor acceptance of the need for more consensus on multimedia protocol standards that could eventually significantly improve the degree of interoperability among the various video conferencing solutions.

The vendors of traditional video group conferencing systems are using their installed base as a point of reference for expanding video conferencing to the desktop. Such solutions can expand the video conference site to individual executives who want the privacy of being connected from their own office. Existing video group conferencing sites appear to represent a significant percentage of the early adoption sites for desktop video conferencing.

The current use of desktop video conferencing generally requires working with a single vendor's product. However, various vendor consortiums are working on providing interoperability solutions.

- Many vendors over the past year have announced support for the Telecommunications Standardization Sectora (formerly the Telephone Consultative Committee, or CCITT) video, audio and data complex of standards such as H.320, H.261 and H.221

- An evolving nation-wide infrastructure of ISDN connections among the various interexchange and local areas is enabling geographically-dispersed desktop-to-desktop video conferencing on dial-up networks

- Multipoint video conferencing technology products and services from AT&T (and its partners) are becoming a reality with AT&T's recently introduced WorldWorx point-to-multipoint media conferencing services.

B
Issues

1. General Impediments to DTVC Mass Market Adoption

INPUT conducted a user and a vendor study on current levels of usage of desktop video conferencing. The surveys looked at:

- Current vendor solutions

- Major impediments to widespread product implementation seen by users and vendors

- Current applications and future applications (The user study of Fortune 500 companies is presented in more detail in Chapter IV of this report.)

Results of the studies indicated the following principal impediments to the development of a DTVC mass market:

- The high cost and complexity of current networking solutions with the current lack of good alternatives for integrating voice, data and video applications on existing corporate network infrastructures. The current per user (seat) cost is typically in the range of $2500 to $6000

- Inferior video resolution (10 to 15 fps versus 30 fps for broadcast-quality full-motion video)

- The need for video bandwidth resource management solutions

- Limitations on bridging and routing of LAN/WAN digital video

- Need for a LAN-based video codec standard—H.320 is not LAN-based

- Lack of consensus on a document sharing standard

- Lack of "shrink-wrapped" video applications which would create a market demand for hundreds of thousands of copies, analogous to spreadsheets or word processing for desktop data processing

- As part of a business process reengineering solution, the need to restructure business work processes to drive the implementation within a particular corporate environment

- Limited multipoint connectivity solutions

- Lack of interoperability among vendor hardware and software with the plethora of video codec, data and interactive communications protocols

2. Key Impediments to the Development of a DTVC Mass Market

INPUT believes that the three most significant impediments to wider adoption of desktop video conferencing are :

1. Lack of acceptable broadband LAN-to-WAN interconnectivity solutions

2. Lack of agreement on industry multimedia protocol standards

3. Current typical DTVC add-on cost per seat of more than $2,000

a. Specific Networking Impediments:

i. ISDN networking solutions

Nearly all current "standard' desktop video conferencing solutions require an additional ISDN network connection for each system. This can present numerous impediments to mass usage:

- Additional network equipment cost per seat for video conferencing that relates to the lack of an ISDN to switched LAN transprotocol solution

- Installation, usage and monthly service charges for an additional network service of ISDN lines in order to add video conferencing at the desktop

- Lack of interoperability among desktop video systems that utilize ISDN technology—being addressed by AT&T through its new WorldWorx multipoint, multivendor connectivity solution

ii. LAN/WAN-based multimedia connectivity limitations

- Ethernet video routing limitations—a barrier to LAN/WAN internetworking of video conferencing

- Time-based transmission issues on Ethernet and Token Ring networks between less time-sensitive data communication and synchronous digital audio and video transmission based on real-time data streams communications

- The requirement for high data rate transmission for full-motion compressed digital video—with a single video and audio data stream often requiring megabits per second transmission rates—that can easily choke standard 10Mbps LAN connectors

- High prices on multipoint bridges to enable multipoint desktop video conferencing

- Early stage deployment of LAN/WAN packet switching technologies, such as ATM, which would improve multimedia communications synchronization with fixed cell solutions

- A time period of two to three years before costs of switched packetized video transmission are reasonable enough for mass deployment at the desktop

- Requirement for fiber optic media to maximize cost efficiencies for wide-scale deployment of desktop and other types of video application services

b. Matrix of Standards

Reflective of an early-stage industry, proprietary video, audio, data and communications standards abound which have represented a way of differentiating products.

Vendor consortiums have formed over the past year to address the standards issues. These have created an environment where very few products (with exception of some recently introduced software-based solutions) provide for interoperability among desktop conferencing platforms.

An abundance of video codec standards exist. However, many of the larger vendors have announced support for the CCITT developed video/audio H.320 "umbrella" standard. There is also work being done to provide for transcoding solutions.

A major issue, however, exists over establishing an interactive document (data) sharing. One of the principal groups addressing this issue is the Personal Conferencing WorkGroup that is working with Intel's ProShare Conferencing Solution to establish a standard API for developing whiteboard applications. This is creating considerable controversy in the industry, but compromises appear to be possible.

The InSoft, Communiqué (Digital Video Everywhere technology) video conferencing software API is an alternative document sharing de facto standard.

Microsoft's technology direction appears to provide a data/voice sharing solution using a single phone line by building an API into Chicago and future versions of Windows NT. This will provide linkages to single voice line technology solutions such as Radish Communication's VoiceView. Presently, VoiceView's technology provides for information transfer in chunks rather than in real time.

Microsoft will also likely support an "open" MPEG (for motion video) command set in its Chicago operating system and also support several DSP drivers within Chicago's Resource Manager. The Resource Manager is an API that will reside between Chicago and the DSP hardware

MPEG is too slow for conferencing video on a regular desktop computer, so it can only be used by receivers.

C
Trends

1. Initial Desktop Video Applications

Early "volume" adopters of desktop video conferencing tend to be larger corporations, such as the Fortune 500. These tend to be for cross-industry type applications, such as:

- Substitution for executive travel

- Remote training

- Executive desktop video connections to corporate video conference room systems

- Communications among high-level engineers and other types of scientists who need to frequently collaborate on design prototypes with their peers across distributed sites

- Long-distance viewing of product prototypes among suppliers and customers

- Point-of-sale kiosks, with a few prototypes that include an element of interactive video conferencing.

2. Leading Edge Desktop Video Solutions

Desktop video conferencing hardware and software product vendors are beginning to address some of the key issues dealing with video routing and switching, which have been major protocol impediments to the widespread adoption of desktop video conferencing. These solutions include:

- InVision's Systems Corporation's InVision™ Desktop Video Conferencing solution, which provides a *de facto* industry-standard packetized video/audio solution (based on the Action Media II codec). It works over TCP/IP or IPX LAN infrastructures as well as WAN infrastructures, such as FT1/T1 dedicated circuits, ISDN switched circuits, and Frame Relay/ATM packet switched backbones. Initially this has been a point-to-point solution, but should be a multicast solution by the end of 1994

- AT&T's desktop video conferencing offerings, including the WorldWorx point-to-multipoint, multimedia conferencing on either switched 56Kbps or ISDN Basic Rate Interface (BRI) lines

  Transcoding technology enables interoperability and multi-point conferencing capability among a variety H.320 compliant systems from a variety of vendors and will also enable participation among non-H.320 compliant systems

  The anticipated charge for the service is $1.00 to $1.50 per minute per user plus the use of a high-speed communication link

- The WorldWorx multimedia network, which will also allow vendors to provide 800 support for PC-based multimedia services. To provide customer support audio/video services, companies can utilize dial-up Primary Rate ISDN lines with prices that apparently will be more in-line with other AT&T 800 services

- AT&T's Vistium Personal Video 1200 Desktop Video Conferencing System which establishes a telephony linkage between the desktop, the local PBX Definity switch and BARI-ISDN linkage

- AT&T Bell Laboratories' VoiceSpan technology which increases the capacity of existing phone lines by splitting a single standard analog phone line into virtual channels for transmitting voice, data and control information. It is based on a full-duplex digital data technology that provides simultaneous communications of digital and analog information that can enhance conferencing applications such whiteboard sharing. A DSP digitizes and maps the analog voice signal into a combined analog-and-data signal

- Proposed ATM over (unshielded twisted-pair) UTP wiring solutions which could facilitate the availability of affordable ATM solutions at the desktop

- Hewlett-Packard's 100VG-AnyLAN, a new Fast Ethernet standard, with its deterministic Demand Priority arbitration system that enables video, voice and multimedia applications that require guaranteed bandwidth and predictable, low latencies that support a frame technology solution

- Creative Lab's ShareView video-conferencing products for Windows, with its proprietary video-compression ratio of 350:1, which allows users to communicate interactively using video, voice and data over a single standard analog telephone line

- Unisys's new desktop video conferencing solution which allows for video routing across Ethernet LAN/WAN interfaces

- Avid Technology's Desktop Video Group, which provides products and technologies for the low to middle spectrum of desktop video production, including vertical markets.

  Avid's desktop video solution, Media Suite Pro 2.0, allows users to create videos incorporating graphics, animation, audio and titles which can be played back from the computer hard drive at a full-screen, full-motion, 30 frames per second (fps).

The product currently is sold as a software and board kit which runs a Macintosh Quadra 900, 950 or IIfx, but Avid is also developing Media Suite Pro for Silicon Graphics, Inc.'s Indigo desktop video family of products.

Media Suite Pro includes support for the Open Media Framework (OMF) Interchange, a standard file format for the exchange of digital media between applications and across heterogeneous platforms.

- Starlight Network's and Novell's video network services and software for managing video LAN storage and network multimedia transmission which address inherent weakness of Ethernet in timely delivery of digital video with such functionality as dynamic allocation of LAN bandwidth

- Lannet Data Communications add-in LANSwitch Ethernet switching modules that support data streams required to run several simultaneous multimedia sessions. They can also support video conferencing. The LANSwitch backplane has a capacity of 1.28 gigabits per second, allowing it to support up to 128 simultaneous 10Mbps Ethernet sessions. The company also offers an optional FDDI connection that links LANSwitch and the StarWorks video server. Lannet also provides an SNMP-based MultiMan/OV management application that lets managers establish up to 256 virtual Ethernet networks within the hub by grouping network addresses.

- Sun Microsystems's ShowMe 2.0 video conferencing solution which addresses bandwidth allocation by letting users adjust the transmission rate to optimize network usage

- The transition from dedicated multimedia boards to single-card multifunction products based on new DSP chips and multitasking software

- Viewpoint System's new multipoint TCP/IP-based video conferencing system for PCs which will support up to four concurrent conference participants and also providing wide-area connects which could enable desktop video multicasting over the Internet

- Ethernet segment switching pioneered by NetWorth. a hub vendor, providing an Ethernet load-balancing capability by using multiple gate access to a server. This utilizes existing 10Base-T networks and also provides a transition to Fast Ethernet and ATM switching technologies

- Smart switching hubs from companies such as Synoptics and Chipcom that can create dedicated bandwidth for video transmission

- Cabletron Systems' family of Full Duplex Ethernet Desktop Network Interface (DNI) cards for ISA buss systems, which provides for bi-directional, simultaneous transmission and reception of data—or double the bandwidth of traditional Ethernet, from 10 Mbps to 20 Mbps

- New graphics cards from PC graphics manufacturers which combine video playback capabilities with graphics acceleration—with support with the high resolution MPEG video codec standard

- National Semiconductor's isoEnet technology—available in early 1995—that will transmit real-time video, audio and data to multiple sites across an Ethernet network (as an alternative to packet-based networks), with WAN transmission connectivity over standard phone lines and existing 10Base-T copper wiring. It will deliver a total bandwidth of 16Mbps at each desktop by adding ISDN layers on top of Ethernet's standard 10Mbps transport layer—used in conjunction with IBM's Person 2 Person software, an isoEnet board will allow color video transmission at 30 frames per second

- Switched ATM LAN/WAN solutions, based on broad band media, such as fiber optic media, that will ultimately address the issue of the two separate data and telephone communication network infrastructures. This currently significantly increases the complexity and cost of networked multimedia solutions, such as desktop video conferencing

- Fore System's 155Mbps ATM adapter cards with drivers for use in Sun Microsystems, Hewlett-Packard and Silicon Graphics workstations with prices ranging from $1,895 to $2,995 per user

- The work of the ATM Forum's Technical Committee on drafting a specification for a midrange ATM traffic rate--51.84 Mbps—to target voice-grade Category 3 unshielded twisted-pair (UTP) wiring which should also assist ATM deployment in LAN environments

- IBM's recently announced strategy to deliver an end-to-end Asynchronous Transfer Mode internetwork architecture, called Broadband Network Services, which will address data, voice and video transmission. It expects to begin shipping in the fall of 1994

Key features relevant to multimedia transmission include:

A. Packet-to-call conversion within its ATM switches which reduces user requirements for ATM adapters

B. Support for variable-length frames as part of a proprietary feature called Packet Transfer Mode which increases the efficiencies of mixed-media transmission with different time-sensitivity requirements but is now as efficient as other ATM switching technologies for data-only transmission

C. Asynchronous transfer mode (ATM), which integrates voice, data and video images across local-area networks and international truck lines, most effectively integrates the two basic types of existing network technologies: data communications and telephone networks.

D. Asymmetric Digital Subscriver Lines (ADSC) which will be able to transmit in combination with ATM technology which could provide interactive vidwo communications at rates up to 12 Mbps over traditional standard copper telephone line.s

E. AT&T's and SGI's recently announced joint venture, Digital Solutions, to leverage AT&T's experience for ATM networks and network management and maintenance with SGI's experience in media servers and services—to build an improved infrastructure for providing video teleconferencing as well as other interactive applications.

3. Leading Edge DTVC Applications

- To date, two of the major markets for desktop multimedia applications are for presentation graphics and document collaboration

- Desktop video and or interactive desktop whiteboard collaboration continue to be primarily cross-industry functional applications. Examples of leading-edge solutions include:

  - PictureTel's solutions for initiating and managing interactive video calls through the Notes environment, a new workgroup type of application

  - Microsoft's proposed multimedia help-desk application which would be provided through an enhanced 800 number service from AT&T

- Vertical markets which are reflecting early adoption of desktop video solutions include:

A. The medical community—particularly medical sites which reflect large campus sites —for remote consultation

B. The banking community—for facilitating multisite loan processing

C. Automotive and aerospace industries—for collaboration among engineers at distributed sites work on various parts of a total product design

D. Construction—for remote site engineering design approval

E. Education—generally at universities which are beginning to provide interactive distance learning environments

F. Legal—for intersite communications, (ie., court room to jail on judicial arrangements of individuals who pose a high security risk)

IV
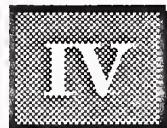
User Survey

A
Introduction

1. Survey Participants

INPUT conducted a mixed survey of 44 Fortune 1000 companies and higher educational institutions to determine current and prospective usage of desktop video conferencing (DTVC). Individuals surveyed included primarily telecommunications and IS managers. The complete questionnaire is provided in Appendix A of this report. The largest number of respondents were from the manufacturing industry (36%) and from educational sectors (16%).

2. Current Usage of Specific Desktop Applications

Respondents were asked to identify widely used desktop applications within their corporations or institutions.

Exhibit IV-1 shows the dominance of four applications, word processing, spreadsheets, desktop publishing and presentation graphics. Twenty-one percent of respondents identified desktop video conferencing as a widely used desktop applications within their corporation or institution. This figure is higher than other INPUT market research indicates.

The high percentage from this survey group suggests some degree of confusion on the part of respondents as to the difference between video conferencing room and desktop video conferencing applications.

However, additional responses to the survey indicate that there is a significant level of interest in the larger U.S. corporations and institutions in DTVC:

- Ninety-one percent of the respondents whose corporations or institutions were currently using desktop video conferencing (DTVC) indicated that there were plans to increase the level of usage.

- Seventy percent of respondents whose corporations or institutions were currently not using DTVC indicated plans to implement DTVC over the next two years.

Exhibit IV-1

Widely Used Desktop Applications Among Survey Respondents

Application	Percent of Respondents
Word Processing	100
Spreadsheets	98
Presentation Graphics	86
Desktop Publishing	84
Image Processing	59
Text and Graphics	55
Text, Graphics, Video	41
Decision Support	36
Document Management	30
Desktop Video Conferencing	21

Number = 44

Percent of Respondents
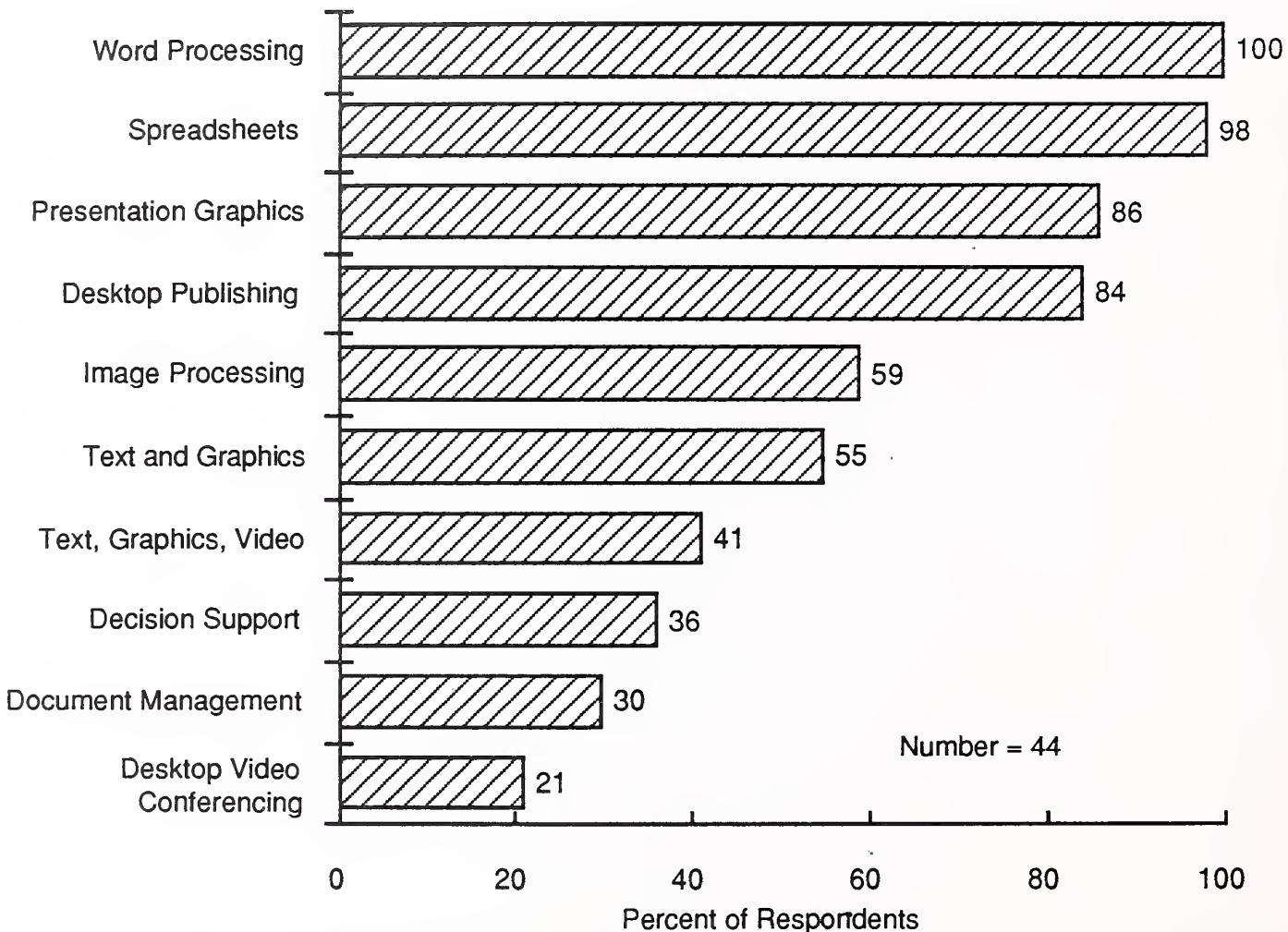
3. Current Types of Desktop Video Conferencing Deployment

No one particular type of DTVC usage showed a relatively high level of current implementation.

- Management conferencing represented the most frequently used at current DTVC solution among corporate respondents.

  However, DTVC for management conferencing was in use at only seven percent of all respondent corporations.

- Public relations, customer support, human resources/interviewing, education/training and engineering and design represented other types of more frequently mentioned applications.

  However, each of these types of applications were in use at only 5% of total respondent sites.

An increase in the usage of media clips for interactive tutorials as a desktop video solution, and an increased usage of image processing and multimedia presentation applications were also mentioned.

4. Future Desktop Video Conferencing Applications

Respondents were asked to identify what they considered to be the most important future desktop video conferencing applications at their corporations or institutions.

Education and training were identified by more than one-half the respondents. The next highest levels of prospective application interest, as shown in Exhibit IV-2 were for human resources, management conferencing, customer service support and engineering and design applications.

Exhibit IV-2

Prospective Desktop Video Conferencing Applications

Application	Percent
Education and Training	55
Human Resources	46
Management Conf.	46
Customer Service	39
Engin./Design	39
Sales and Marketing	34
Public Relations	32
Workgroup Plann.	32
Manufacturing	18

Number = 44

Percent of Respondents
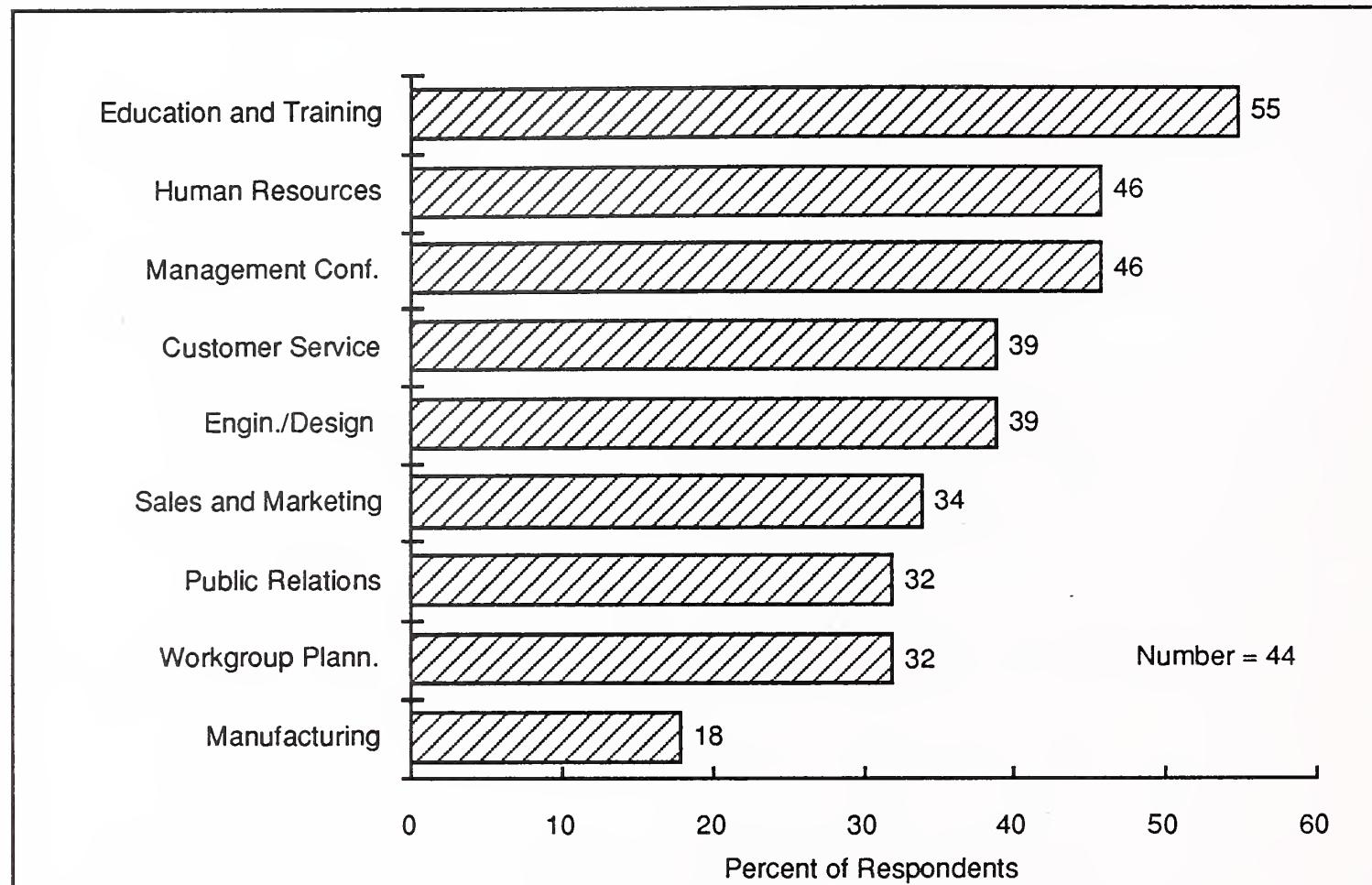
5. Principal Deterrents to Current Implementation of Desktop Video Conferencing

Network communications costs, and the cost of supplemental implementation and support were the two major deterrents to current desktop video conference implementation cited by survey respondents, as indicated in Exhibit IV-3.

INPUT's vendor and secondary research strongly reinforces these user opinions. The present bandwidth limitations of twisted pair-based local networks and internetworking problems, such as the limitations on routing of digital video transmissions, present significant barriers to the development of a mass market for desktop video conferencing in the corporate or other institutional environments.

Principal Deterrents to Corporate Implementation of Desktop Video Conferencing

A horizontal bar chart titled "Percent of Respondents" (x-axis) with the following categories and values:
- Network Communication: 58
- Support Costs: 49
- Lack of key application: 27
- Lack of Appl. Development: 21
- Plethora of Standards: 18

Number = 44
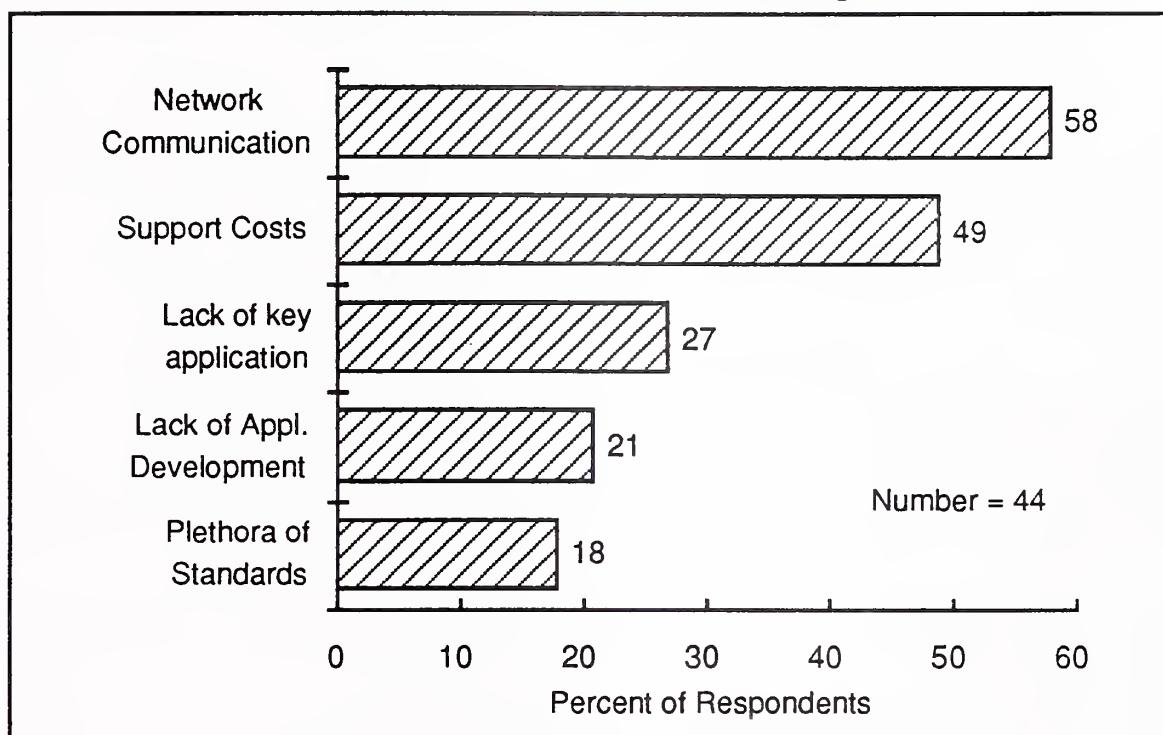
6. Relative Importance of Cost Per Seat As an Incentive for the Purchase of DTVC

The per-user or per-seat cost for DTVC has frequently been mentioned in various industry reports as a significant deterrent to mass adoption of the technology.

INPUT used a pricing range of $300 to $2500 in its users survey to determine where there might be a price level that would trigger significant purchasing interest in DTVC.

- $1000-1500 was a range where 35% of current non-user respondents showed interest in purchasing a DTVC solution.

- However, 40% of the non-users were not interested even at a price as low as $300 per seat

An additional qualifying factor is how critical the DTVC solution is to the corporate mission. For DTVC as a cross-industry solution, similar to E-mail, a price per seat in the range of $100-200 is probably realistic for mass market interest adoption.

However, for executives or other senior personnel, where time savings has a high value, INPUT's surveys have shown interest in significant purchasing volumes for DTVC solutions at up to $15,000 per seat, with value-added features that maximize the usage of the technology over current corporate network infrastructures.

7. Desktop Video Conferencing Technology Acquisition Sources

Users were asked to identify the type of vendor from which their corporation or institution was likely to buy DTVC products.

Telecommunications and computer systems vendors were the most frequently mentioned potential vendors. (See Exhibit IV-4).

Exhibit IV-4

Desktop Video Conferencing Vendor Preferences

Bar chart — "Percent of Respondents" (Number = 44):
- Telecommunications Vendor: 33
- Computer Systems Vendor: 15
- Application Software Vendor: 12
- SI Vendor: 12
- Systems Software Vendor: 12
- Computer Retailers: 9
- Board Manufacturer: 6
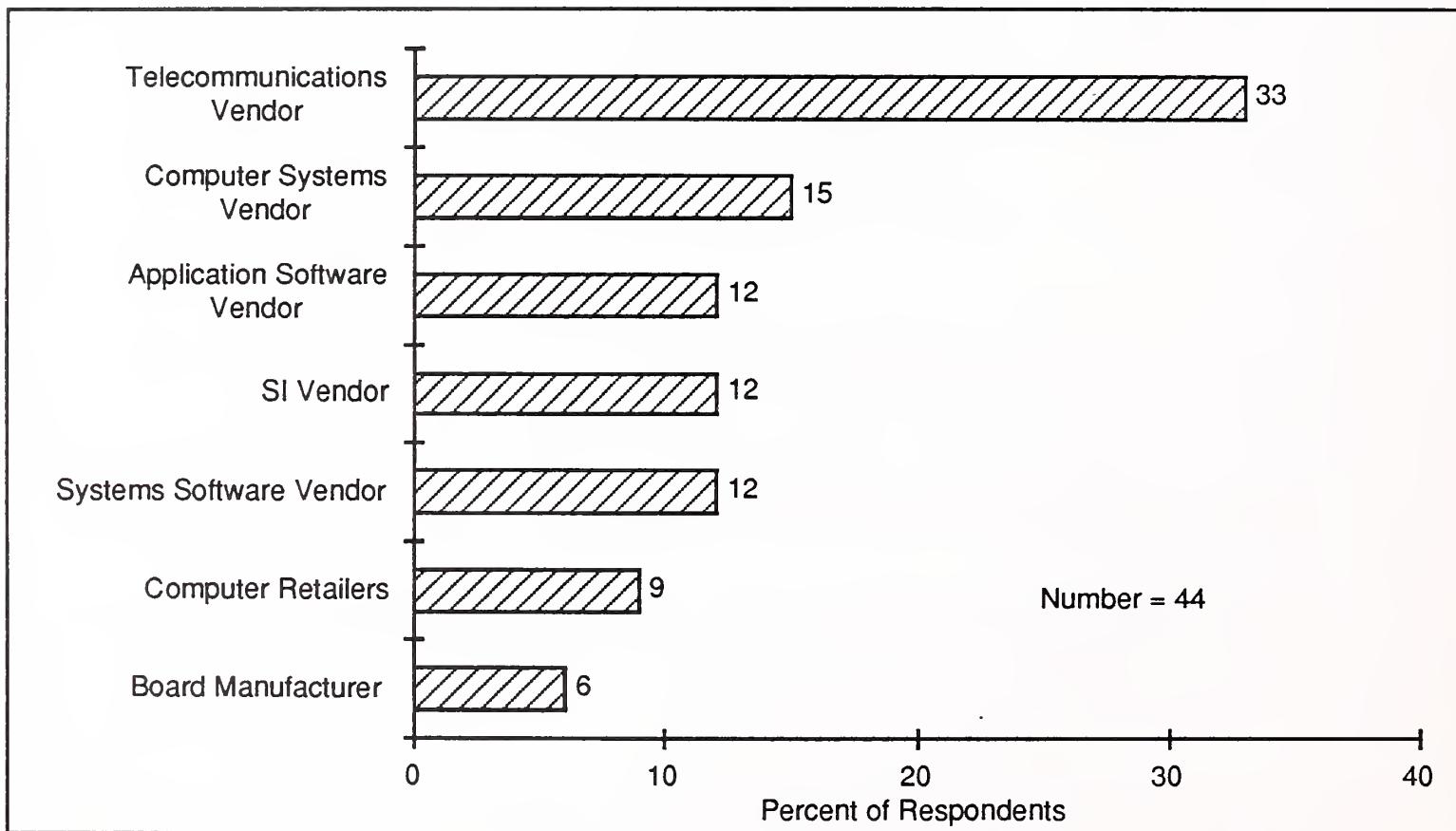
The telecommunications industry should be a major beneficiary of DTVC because of the need for telecommunications network equipment and services infrastructure upgrades as a key enabling technology for widespread desktop video conferencing implementation.

8. Preferences for a Particular Type of Desktop Video Conferencing Solutions Provider

Survey respondents were also asked to indicate the source of implementation of a broadly-based DTVC solution.

Seventy-three percent of the respondents indicated that implementation would most likely to done internally by the IS department. (See Exhibit IV-5).

Exhibit IV-5

Preferences for DTVC Implementation
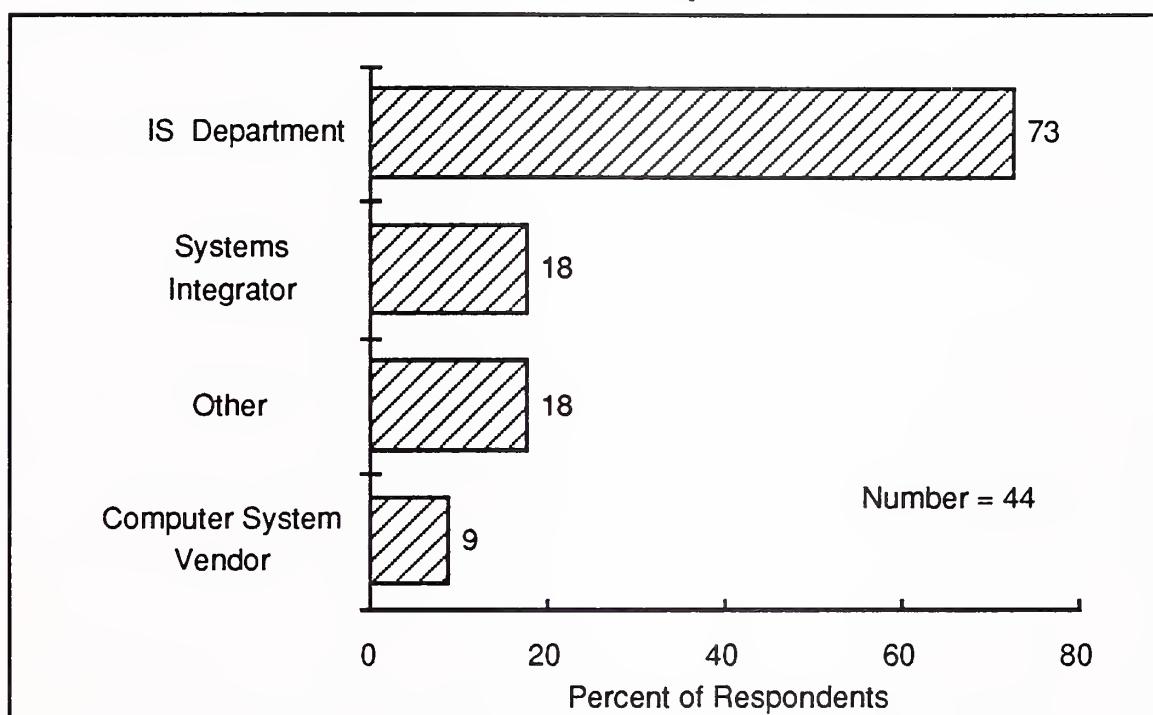
Several respondents indicated that it was too early in the cycle for possible adoption of DTVC to have considered who would have the responsibility for implementing a broad-based solution.

INPUT's survey of systems integrators indicates that DTVC is in the early prototype stage of corporate adoption. However, it would appear that a major market opportunity exists for systems integrators and professional services vendors for front-end consulting services.

Actual widespread corporate or institutional adoption of DTVC will likely involve a tie-in with business process reengineering and the implementation of changes in work group processes. Partnerships between DTVC systems suppliers and consulting

firms will be required to provide the "missionary" work necessary for widespread market adoption.

In addition, partnerships with telecommunication equipment and services vendors will be needed to address the requirement for network infrastructure upgrades to facilitate a corporate-wide LAN/WAN-based DTVC solution.

V

Competition

A
Introduction

1. Types of Vendors Providing DTVC Solutions

The relatively short history of the DTVC market has produced a variety of vendors providing various degrees of a complete DTVC solution:

- The original DTVC vendors are systems suppliers with a product history in video room conferencing and customer-based telecommunications equipment. A few of these companies also provide customer application development tools and professional services as part of their total DTVC system solutions

- Board-level video/audio and network interface peripherals manufacturers are also key suppliers to the DTVC market. They provide add-on solutions for customers with existing desktop computers (as a complementary product offering for the desktop computer vendors) and also DTVC peripherals to DTVC systems suppliers

- A higher growth segment of the DTVC market is document conferencing which lets users share a common whiteboard. This category of desktop conferencing software is currently finding a much higher level of acceptance than desktop video conferencing. Price per seat levels start at under $100. Such solutions often require two regular phone lines, one for document conferencing and the other for audio transmission

- Software companies addressing the DTVC market are beginning to provide software solutions that include, data conferencing (providing simultaneous voice and data

transmission), digital video protocol transcoding and algorithms for enhancing current deficiencies in technology for digital video internetworking

- Some of the more recent computer systems participants in the DTVC market are providing more of a total solutions approach

- Systems integrators and professional services companies appear to be evaluating the market and waiting for further enhancements in the technology that could lead to the development of significant vertical market opportunities.

2. DTVC Systems Market Share Leaders

As indicated in Chapter III, INPUT estimates the shipment rate of DTVC systems in 1994 will be in the range of 35,000 units. Intel probably now represents market leadership in terms of units shipped with its per seat price point of less than half the typical per seat industry pricing in 1993.

Current U.S. market share leaders, as estimated by INPUT, are listed in Exhibit V-1.

Exhibit V-1

Leading U.S. Vendors of DTVC Systems

• Intel	• Compression Labs
• Northern Telecom	• IBM
• AT&T	• Hewlett-Packard
• PictureTel	• Sun Microsystems
• GTE	• Silicon Graphics
• MCI	• Creative Labs' ShareVision

B
Selected Profiles of DTVC Software and Systems Vendors

1. Intel's ProShare Personal Conferencing Video System 200

ProShare provides one-to-one desktop video conferencing at less than $2,500 per seat with an easy-to-use interface that includes a graphical dialing pad which stores numbers for speed dialing, and an address book that can store screen captures of callers.

Resellers and phone companies are discounting the product to the $1,000 to $1,500 per seat level. Other partners include AT&T, MCI, Compaq Computer, Dell Computer and video conferencing systems providers.

The Vision System 200 solution includes two 16-bit ISA cards (a video digitizing board and an ISDN board with audio); a camera that attaches to the monitor; a combination earphone/microphone; Windows software; and the ProShare whiteboard software.

The ProShare whiteboard part of the Video System 200 is also sold separately for $99, and will operate on NetWare 3.11 and 4.x networks. The program also supports Object Linking and Embedding (OLE) with support for spreadsheet and other applications linkage promised in the $299 Premier edition of the software. It uses a notebook metaphor in which each page becomes its own whiteboard screen which allows for work on different document pages concurrently.

It provides a video transmission rate of 8 to 15 frames per second, and a video image in Indeo Release 3.2 of a 320-by-240 video in a 640-by-480 window. Use of an ISDN line is required..

The Video System 200 is based on Intel's own DVI/Indeo codec algorithm that compresses the outgoing video in hardware but decompresses incoming signals in software. System usage is optimized on Intel's Pentium-based PC chip technology. The Intel Pentium solution also addresses the issue of programmability of compression technology.

The Intel DTVC product includes PC-based proprietary Intel Indeo codec. Currently, the international H.320 and H.261 telecommunications standards are not supported. Support for the H.320 compression standard is scheduled for later in 1994.

2. Northern Telecom's Visit Video, Version 2.0

A competitive strength of Northern Telecom's Visit DTVC solution is its Macintosh-PC cross-platform compatibility. The Visit works over ISDN or Switched 56 lines, either two or four wire. A separate line is required to carry video transmission.

With the use of Northern Telecom's Meridian PBXs, it also provides telephony functionality that allows for the initiation of both calls from the Visit platform. It provides video display at up to 15 frames per second.

The cost per seat is approximately $5,000. The Visit system includes a complete solution for setting up a DTVC solution, including: a full-length video capture board; an M5000TD-1 ISDN terminal adapter; a Northern Telecom NT-1 network terminator; and a video camera. Visit also includes whiteboard software called ScreenShare, which allows for transmitting and receiving files but does not support applications sharing.

Northern Telecom also has a DTVC application development toolcalled Visit Access. It is now used primarily to provide support for custom development of DTVC applications.

3. AT&T Global Information Solutions' Telemedia Personal Video System

The AT&T Telemedia Personal Video System (recently renamed as the Personal Video 13) provides for real-time application sharing. Video transmission quality is approximately 15 frames per second with a pixel density of 352-by-240 over an ISDN connection. It also provides compatibility with the Common Intermediate Format H.320 standard.

The Telemedia System cost is approximately $5,000 per seat, which includes: a camera, adapters, cable and software. A fully-configured system, preinstalled in a 486DX2/66-based AT&T PC with 16 MB of RAM, a 324 MB hard disk, cache memory, a graphics accelerator and a 17-inch monitor costs around $9,000.

The new client package for PC-based video conferencing and application sharing is the Vistium Personal Video System. This product family is designed to use AT&T's WorldWorx Network Service, which includes ISDN, Switched 56 and related services.

The Vistium family includes: a $200 package called Share software, which allows for the sharing of applications; the Personal Video 1300, a two-board product that uses Share Software (with a Hayes compatible modem) and performs video capture and compression in hardware. The Personal Video 1200,

a $2,000 single-board solution that performs video overlay and decoding in software

The Personal Video 1300 is priced around $5,000 as a add-in and around $6,000 with an AT&T 33MHz 468DX Globalyst PC. The Personal Video 1300, which is now shipping for point-to-point communications was formerly called the Telemedia system. A multipoint version of the Personal Video System is expected in the first quarter of 1995. It will be based on AT&T's MultiPoint Control Unit technology. Telephony connections to PBXs will enhance local call routing.

With its WorldWorx video and data calling solution, AT&T is packaging offerings designed to ease installation and provide complete customer solutions. Customer applications are being developed in areas such as distance learning, remote access to experts, customer sales and support and collaborative work teams.

The first packaged solution is called the WorldWorx Desktop Solution, which integrates an AT&T Globalyst PC equipped with AT&T's Vistium Personal Video System with the WorldWorx Network Service.

4. IBM's Person to Person/2 Workgroup Software

Person to Person/2 is a collection of tools for conducting multi-point (four to eight people) real-time computer collaboration with or without video over a LAN, asynchronous connection, or ISDN lines.

It is priced at approximately $280 per seat. IBM's fully configured video conferencing offering, which provides for full motion video, is priced at approximately $5,000 per seat.

Desktop video conferencing can be implemented with the Person to Person/2 Video tool with an IBM ActionMedia Display Adapter and a video camera. Video transmission rates can be up to 15 frames per second.

Transmission is multipoint, with four to eight people supported per call.

Captured images can be shared with the Chalkboard or a Clip utility. Video can be received without an ActionMedia card using

software emulation. A bitmapped image, updated regularly in a Video Window is utilized.

Support is provided for a number of network protocols, including, Ethernet, Token Ring, NetBios, NetWare, ISDN and LAN to ISDN interfaces. Support for H.320 will probably be provided in the future.

The Chalkboard whiteboard tool allows users to share, paste and annotate text and graphics. The Talk tool allows for voice communications without an additional phone line.

The File Transfer tool allows files to be moved in the background, even to unattended machines. Platform requirements include the OS/2 2.1 operating system

5. Hewlett-Packard's Enterprise Desktop

The HP Enterprise Desktop solution is based on the HP 9000 Series 700 workstation. With software tools such as MPower 2.0, it enables interactive collaboration on projects using a broad range of media—including audio, image, graphics and video. It also allows equal access to the information in real-time with shared whiteboard, fax, mail or print.

Hewlett-Packard also provides a consulting service for its HP Enterprise Desktop solution which helps with planning, integrating installing and managing the systems.

6. InVision Systems Corporation's InVision Release 3.0

A software-only solution, InVision, provides one of the few DTVC solutions that maximizes video conferencing over packet-based high-speed LANs and WANs. WAN infrastructures supported include: FT1/T1 dedicated circuits, ISDN switched circuit and Frame Relay/ATM packet switched backbones. It also lets the user adjust the bandwidth of network traffic from 56Kbps to 512Kbps with a frame rate to 20 frames per second.

Video conferencing codecs supported include the Intel Action-Media II and Media Share's Mambo DVI card and Microsoft Video for Windows. An optional whiteboard application, called VisionGraphics, which is priced at $195, incorporates Future Labs' Talkshow.

The list price is $995. However, a video capture board, video camera, 16-bit network adapter or modem must be provided, with at least 386-based PC platform and 8 MB RAM storage are also required for a systems solution. A complete per seat add-on configuration could add a couple thousand dollars to the price of a total solution.

7. Silicon Graphics' InPerson DTVC solution based on the Indy Workstation

Silicon Graphics' Indy workstation provides all the hardware and software needed for capturing and communicating with video and sound over a network or over a digital phone line. The price of this multimedia configured Indy starts at $5000. The Indy represents the high end of desktop video technology.

A particular strength of SGI's digital media products is as a video server to provide access to stored images and video across geographical distances.

A fully configured Indy for desktop video includes the SGI-designed IndyCam, a digital color camera that sits on top of the monitor. It provides for a maximum video transfer rate of 30 frames per second with 512 by 492 8-bit color pixels. It contains two SGI-designed ASICs. The resolution is high enough to capture text from a typewritten page. It also allows for the attachment of a camcorder, video disc player or video camera directly into the NTSC/PAL video or S-video port.

With the huge bandwidth (up to 267Mbps) of its graphics I/O bus and its advanced graphics subsystem, the standard Indy can send 32 million pixels to screen memory in a second that regenerate a 640-by-480-pixel frame at 50 frames per second. It also contains a powerful speech recognition/voice control system that supports a speaker-independent vocabulary input.

The Silicon Graphics collaborative whiteboard solution for the Indy DTVC solution is called InPerson—unbundled from the Indy systems product. It allows group collaboration in real time video, audio and data sharing on a selected files, captured images or text documents.

InPerson is also integrated into the Indigo Magic User Environment that allows for placing calls and distributing

materials through a point and click interface, distributing Whiteboard work through MediaMail and incorporating work into Indigo Magic applications such as Showcase. InPerson can be used with existing network routers over any type of TCP/IP network, including Ethernet, FDDI and ATM. InPerson uses the "multicast" network transmission protocol to transmit data.

InPerson also automatically adjusts video usage to alleviate network congestion.

The video frame rate and resolution are user selectable. They use the Indy Video and Galileo Video codecs but the Indy can probably support additional codecs with it software compression/depression processing capability.

8. SunSolutions' ShowMe 2.0 DTVC Solution

ShowMe 2.0 provides for a complete video, audio, application sharing and a real-time whiteboard collaboration DTVC solution.

A DTVC-enabledSun workstation includes a ShowMe video camera with audio input through a SunMicrophone and output through the workstation's speakers. It is based on Motif graphical user interface and operates over TCP/IP networks.

An automatic bandwidth allocation feature allows users to optimize network usage by adjusting transmission rates.

ShowMe Shared App software enables multiple users to interact with a live application simulanteously. Remote users can participate in on-line meetings without the application loaded on their workstations.

ShowMe 2.0 began shipping in December 1993, running on SPARC systems in the SunSoft Solaris operating environment. Versions of ShowMe 2.0 for Hewlett-Packard, IBM workstations, Microsoft Windows and Solaris X86 platforms are scheduled for shipment in 1994.

The list price of ShowMe 2.0 is $3,270 for a single user and $8,430 for a three-user right-to-use (RTU) license. This includes a video camera, a Sun Video card, CD media and documentation. ShowMe Shared App, ShowMe Whiteboard and ShowMe Audio, as an audiographics configuration, have a suggested list price of $899 for a single RTU license, $1,650 for a three-user RTU license,

$3,750 for a 10-user RTU license and $26,200 for a 100-user RTU license.

9. Starlight Networks Inc. StarWorks Release 1.7 networking software

Starlight Networks' products allow for real-time storage and network management of digital video applications.

Its current technology includes video application servers, based on a client/server platform configuration that allows up to 40 simultaneous users to share full-motion, full-screen video applications. It also supports a variety of network configuration and video codecs.

The recent StarWorks upgrade provides users with up to 50Mbps of video/audio streaming capacity and adds bandwidth reservation, which is designed to improve throughput to multiple users. This will provide desktop users with Ethernet links as much as 1.2Mbps throughput. This will require, however, an FDDI backbone between the StarWorks server and an Ethernet switched hub.

The company's technology, as it continues to evolve, will be complementary to store and forward digital video applications, broadcast video and eventually desktop video conferencing over LAN/WAN network configurations.

10. Compression Labs' Cameo Personal Video System

The Cameo Personal Video System was introduced in January 1992. The Cameo provides point-to-point color, DTVC over ISDN, Switched 56 Kbps digital transmission and Ethernet LAN transmission. On a LAN, each connection utilizes approximately 2.2% of a 10 Mbps Ethernet. A separate telephone call is made for audio transmission.

Its compression solution is based on CLI's PVS technology. It also supports NTSC, PAL, SECAM still frame input for graphics and NTSC input for motion video. The video is displayed on the Macintosh using a built in video digitizer (Macintosh AV computers) or a video digitizing card such as a RasterOps 24STV. It can transmit up to 15 frames per second.

11. PictureTel Corporation's LIVE PCS 100 Personal Visual Communications System

PictureTel LIVE is a complete H.320-based personal visual communications add-on solution priced at approximately $6,000 for personal computers running Microsoft Windows 3.1. PictureTel LIVE provides dial-up visual communications, screen sharing and collaborative computing over public switched digital networks. It is fully compatible with all PictureTel and competitive systems operating in the H.320 mode.

The PCS 100 consists of two ISA boards which provide video and audio compression and switching, high resolution Super VGA accelerated graphics, video windowing and a BRI ISDN interface. The PCS 100 also includes PictureTel's new FlipCam, which can be adjusted for a variety of subjects and lighting conditions using manual zoom, focus and aperture controls, a speaker phone/handset and easy-to-use user interface software.

IBM's Person to Person collaborative software is also integrated with the PictureTel LIVE DTVC solution. The PictureTel Live Video Connect Series for Lotus Notes allows Notes users to initiate and manage interactive video calls through PictureTel Live from the Notes environment.

PictureTel also provides the Developer's ToolKit which is a component of PictureTel's Video Application Development Environment (VADE). VADE provides software building blocks for programming advanced video conferencing capabilities for all PictureTel product families, including the PictureTel LIVE desktop system.

12. Novell's Fluent NetWare-based software products

Novell acquired Fluent, Inc., for $17.5 million in 1993. Novell is working on leveraging Fluent's video networking products that provide integrated full-motion video and audio into networked applications by integrating this technology with Novell's network management system software.

The goal is to provide the means to add full-motion synchronized video and audio on existing LANs.

Novell plans to make network services for multimedia available in phases beginning in 1994. The first phase will support network

server-based video playback. Additional phases will extend its
network services to the support of desktop video conferencing.

13. Intelligence at Large, Inc. BeingThere

The BeingThere DTVC solution is a software-only solution.
BeingThere DTVC software solution provides open connection to a
single point of contact—whereas BeingThere PRO provides multi-
point communication.

The software is designed to work with Macintosh computers and
peripherals. Any 68030 or better Macintosh running BeingThere
can use the collaboration features and receive sound and video

Sending video (optional) requires a camera and a video input card
or video SCSI input device. Apple's AV technology supports
sending video to a video input card. In order for the other person
to hear, a Mac with full duplex sound capabilities is required.

BeingThere works best over Ethernet and Token Ring networks.
Lightly loaded LocalTalk networks will also support collaboration
features and either audio or video signals (not both). BeingThere
software also works with most hardware routers, hubs and
similar network devices.

The price for copies of BeingThere range from $299 for one copy to
$2,490 for ten copies. The company recently introduced three
different Video conferencing Starter Kits. Starter Kits start as low
as $349/per user which includes camera and software and are
limited to a single Kit per site.

14. Creative Labs' ShareView and ShareView Plus

Creative Labs, Inc., is the U.S. subsidiary of Singapore-based
Creative Technology, Ltd. which manufactures and markets the
widely-adopted Sound Blaster system.

Creative Labs acquired ShareVision Technology, Inc., in June of
1993.

The ShareView DTVC add-on boards provide the unique capability
of allowing for the transmission of video, voice and data over a
single standard analog telephone line with a video compression
ratio of ShareView Plus of 350:1. Also, products allow users to

share applications, such as spreadsheets even if only one participant has the installed software.

The ShareView products support the Macintosh and PC platforms.

A ShareView DTVC systems include ShareVision's Onsight software, a hands-free headset and an audio card with a 14,400 bps fax/modem. Systems prices start at below the $1000 per seat.

15. Peregrine Systems NTV software-based DTVC solution

Peregrine has announced, but is not yet shipping, its NTV desktop video conferencing and collaborative computing software solution for Windows users over existing networks. NTV is being designed to turn any Windows application into a groupware application allowing users direct access to interactive on-screen information and enabling them to also participate in real-time video conferencing from the desktop.

NTV is especially targeted for large companies or institutions that have geographically disbursed facilities connected by LANs or WANs. It will operate in either an interactive or broadcast-only mode. NTV will be hardware independent, to provide real-time screen sharing, and to use existing local and wide area networks for communication among users.

There is no white-board solution in NTV, but it provides application and screen sharing as well as asymmetrical installation.

NTV will allow for the simultaneous use of different compression/decompression technologies and will transmit 10-22 video frames per second depending on the type of computer processor, speed of the capture board and network load. Multi-point support for four users is supported with optimum performance.

Peregrine Systems has indicated that the product will be licensed with OEM hardware partners, and it has estimated that a fully configured system, which includes a video capture board, audio board, speakers and camera, will be priced in the range of $500-1,000.

16. The UNISYS PW^2 Desktop Video Conferencing System

Unisys recently announced the PW^2 Solution Series Desktop
Videoconferencing System which provides point-to-point video
conferencing with synchronized. audio, full-motion video, and
multipoint data sharing over existing LANs. It is an integrated
(turnkey) solution that includes a video overlay board, video
camera and speakerphone/handset and a software suite for
interactive video conferencing with synchronized audio and
multipoint data conferencing. In addition, annotation, drawing,
video frame capture and screen capture tools are provided in
addition to a "chat" tool used as an alternative to synchronized
audio or for note taking during data conferencing session.

The Unisys PW^2 Solution Series DTVC System is based on the
Unisys 66 MHz Intel 486 DX2-based MPI 46664 PC. Each system
includes 8 MB of memory, a 270 MB SCSI hard disk drive, a 17-
inch color monitor and an accelerated SVGA video controller.
Each system also has four ISA bus and two VL-bus slots. Three
are used by the codec, video capture and Ethernet cards, with
three slots available for peripheral expansion. The basic platform
is also available with a range of memory, mass storage, backup
and peripheral expansion options.

Key to the video conferencing system is a codec board which offers
high-speed data rates of over 2Mbps using industry-standard
H.261 and G.711 compression algorithms.

The Unisys Desktop Videoconferencing System supports TCP/IP,
which enables use of the system over wide area networks with
standard bridges and routers, which could be particularly
beneficial in multi-site campus-settings and for corporations with
remote offices.

The user-controlled data rate can be scaled from 56 Kbps to 2,048
Kbps at full motion video frame rates of up to 25 frames per
second. Video windows can also be scaled from icon-sized to full-
screen 640 x 480 resolution. It also provides support two industry-
standard resolutions: QCIF which provides 176 x 144 pixel
resolution and CIF which offers 352x 288 pixel resolution.

The single system price starts at $12,995.

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VI

Conclusions and Recommendations

A
Conclusions

Exhibit VI-1 includes some of the technical and sociological barriers to current wide-spread product acceptance.

Exhibit VI-1

Current Barriers to Widespread DTVC Adoption

- Need for corporate LAN/WAN infrastructure enhancements to effectively integrate video applications on the LAN
- High price per seat costs
- Lack of cross-product interoperability
- Lack of a mass market type application
- Low-quality, synchronized multimedia transmission in many systems
- Lack of multipoint conferencing solutions
- Requirements for changes in work processes to accelerate corporate-wide adoption

INPUT's surveys indicate that the most significant barrier to widespread DTVC acceptance within the business community is the inability of most systems to efficiently use existing LAN and WAN internetworking infrastructures.

Most systems are now based on desktop ISDN dial-up network solutions, which involves additional networking costs with the potential for considerable cost variance.

AT&T's recent introduced WorldWorx video conferencing services program addresses some of the problems of multipoint access and vendor interoperability. This could stimulate usage of ISDN networks if it also results in reduced ISDN network usage costs.

Also, telecommunications equipment vendors are implementing customer-site PBX to LAN interfaces which should create more efficient corporate usage of digital wide area networks. However, a more optimal network solution is the ability to conduct desktop video conferencing over the same LAN and LAN/WAN infrastructure now used for corporate data communications.

Asynchronous Mode Transfer (ATM) LAN switching technology represents the best prospect for the eventual integration of voice/video/data transmission over a single network infrastructure. Also, for widespread, heavy usage of video transmission LANs and WANs will need to be fiber optic.

A few computer systems and systems software vendors have recently announced solutions which can be routed across Ethernet-based LAN/WANs. These represent product innovations which could stimulate more general corporate adoption of DTVC because such solutions also provide for high-speed, high quality video transmission, unlike many systems today which lack full-motion video resolution.

Initial users for these high-end, higher video quality solutions are individuals whose high-level salaries and/or heavy travel requirements justify using video transmission based on time and transportation costs savings. Examples include:

- Medical specialists who can communicate on patient diagnostics or treatment, with high-quality video transmission

- High level executives in the financial services industry where timely decisions can increase corporate profits

- Senior engineers in distributed locations with the need for frequent communications on total systems design considerations

- Long-distance viewing of product prototypes among suppliers and customers

- Remote site workers who need to address emergency situations, such as in the energy industry

Price per seat sensitivity is particularly important for mass market DTVC adoption. INPUT surveys indicate that at $1,000 per seat there would be a meaningful increase in DTVC usage. However, the price per seat probably needs to drop to below $300 in order to create mass market demand. However, INPUT's vendor surveys indicate that there are companies with high-end DTVC solutions in the price per seat range of $6,000 to $15,000 which utilize existing LAN and inter-LAN network infrastructures that are experiencing strong product acceptance in particular niche markets.

Desktop video conferencing is one type of workgroup application that needs to be evaluated within the context of corporate work processes. One of the most effective ways for introducing desktop video conferencing into the corporate environment is through a business process reengineering approach which would involve the promotion of usage by top-level management.

An optimal DTVC solution would provide multimedia, multi-point sharing across broadband networks as a general-purpose workgroup applications. Consideration, however, must also be given to people in a corporate environment who might consider video conferencing at the desktop an invasion of personal privacy. Privacy issues could be addressed by enabling users to turn off the video portion of their desktop conferencing systems.

Also DTVC in the corporate environment might upset current hierarchical reporting structures by creating an overall more intimate corporate communications environment.

INPUT vendor surveys indicate that currently the most popular segment of DTVC is document collaboration. This type of communication can efficiently uses existing LAN/WAN infrastructures as well as dial-up analog phone lines.

B

Recommendations

Vendors of DTVC solutions should be cognizant of a development toward a segmented DTVC market into high-end commodity type solutions.

Within a couple of years, prices of general purpose DTVC solutions could average less than $1,000 per seat compared to typical current price ranges per seat of $2,500 to $5,000.

Principal vendors that can provide lower cost DTVC systems include desktop computer systems vendors, OEM systems providers and network service providers that use DTVC functionality as a way of expanding the market for their core products.

An area of product weakness today is development tools for creating industry-specific DTVC solutions. Such tools will be necessary in conjunction with professional services, to provide custom solutions to obtain value-added pricing in the DTVC market.

Professional services, systems integration and video server vendors will eventually find a more lucrative and potentially much larger market than just DTVC in providing video server connectivity to the desktop video environment with video-on-demand and broadcast video applications. This will require network infrastructure upgrades, and partnering with telecommunications equipment partners could prove to be very beneficial.

Services vendors will also benefit from front-end consulting on reengineering a corporation's business processes in order to benefit from desktop video as well as from facilitates management contracts for managing complex multimedia based networks.

Software vendors addressing the DTVC market should look to developing additional LAN-based standard applications for cross-industry solutions such as customer services, education and training and human resources.

Major beneficiaries of the increased usage of DTVC will be companies providing:

- Telecommunications equipment

- Video server hardware and software

- Broadband network management software product

With maturing in ATM technology and expected substantial cost reductions over the next two to three years, companies will be required to upgrade network infrastructures (i.e., to be able to integrate over a single network voice, data and video) to gain cost advantages.

Exhibit VI-2 summarizes INPUT's recommendations for vendors on how to maximize their positioning in the emerging DTVC market.

Exhibit VI-2

Recommendations for Vendors Addressing the DTVC Market

- Partner with telecommunications vendors that will be able to provide complementary equipment and services capabilities, particularly LAN/WAN solutions, including ADSL (Asymmetric Digital Subscriber Lines)

- To help maximize profitability, provide application development software tools as well as application development services

- Develop new generations of DTVC products that support multiple video and network communications protocols

- For low end DTVC suppliers, reduce sales and marketing costs by the use of indirect sales channels such as distributors, large retailers, professional services companies, VARs, in addition to telemarketing and direct mail

- High-end DTVC vendors should address vertical markets with a broad base of value-added services

- DTVC vendors with broad-based video technology capabilities should look to the video server store and forward (video mail), video-on-demand and broadcast video markets for much greater market size potential and profitability than the market for DTVC. These other types of LAN-based video applications could ultimately become the driving forces for widespread adoption of DTVC.

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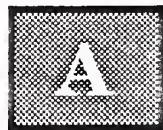
Questionnaire

CONFIDENTIAL

Questionnaire—Use of Desktop Video Applications

INPUT is conducting a study on the desktop video computer systems and applications markets, with an emphasis on interactive desktop video conferencing solutions. This questionnaire is being used to survey U.S. businesses and other types of institutions on current and prospective desktop video conferencing applications.

INPUT is a market research, management consulting firm which has followed the information technology industry for twenty years.

Participants in the study will receive a copy of the Executive Overview Chapter of the final report.

1. Which of the following desktop applications are widely used in your company/institution?

   ___ Word processing

   ___ Spreadsheets

   ___ Desktop publishing

   ___ Presentation graphics

   ___ Decision support

   ___ Image processing

   ___ Work group—document management

   ___ Multimedia—text and graphics

___ Multimedia—text, graphics, and video

___ Multimedia—desktop videoconferencing

2. Please describe any current desktop video applications at your company/institution.

_____

_____

_____

_____

3. If desktop video conferencing is currently being used at your company/institution, what are current applications?

___ Management conferencing

___ Workgroup planning

___ Customer support

___ Engineering/Design

___ Manufacturing

___ Public relations

___ Other, industry specific _____

___ Other _____

4. Is your company/institution interested in deploying new desktop video conferencing applications over the next one to two years? Yes ___ No ___

5. Which of the following desktop video conferencing applications would be of interest to your company/institution in any future deployment?

___ Education and training

___ Sales and marketing

___ Engineering/Design

___ Manufacturing

___ Customer Services

___ Public/Investor relations

___ Human resources/personnel

___ Desktop video conferencing/management

___ Workgroup planning

___ Industry specific _____

___ Other _____

6. If your company/institution is *not* currently utilizing desktop video conferencing technology, which of the following could be considered principal deterrents?

    ___ Network communications costs

    ___ Cost of systems implementation

    ___ Plethora of de facto digital video standards

    ___ Lack of appropriate application development (authoring) tools

    ___ No particular suitable application

7. Did your budget for desktop video conferencing applications increase in 1994 from 1993? Yes ___ No___

7a. If yes, what was the percentage increase? _____

8. Where would you purchase desktop video conferencing technology?

    ___ Telecommunications vendor

    ___ Computer retailer

    ___ Computer systems vendor

    ___ Board manufacturer

___ Systems software vendor

___ Applications software vendor

___ Systems integration vendor

9. Who would implement a desktop video conferencing network at your company?

___ IS Department

___ Systems integrator

___ Computer systems vendor

___ Other

10. What price per seat would stimulate interest in desktop video conferencing at your company/institution?

___ Under $2,500

___ Under $2,000

___ Under $1,500

___ Under $1,000

___ Under $500

___ Under $300

Thank you for your participation.